

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF PUBLIC INSTRUCTION

Organization and Courses of Study
in
Anthracite Coal Mining
for
Mine Foremen and Assistant Mine Foremen



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FOREWORD

In the interest of economy and safety, the state mining law requires that certain mine employees have special training and education. This bulletin has been prepared in order to assist school districts in organizing courses of study and conducting evening classes that will help prospective mine foremen and assistant foremen to meet the requirements of the State mining law.

The State Department of Public Instruction desires the cooperation of all agencies interested in the improvement of instruction in evening mining classes conducted by the public schools. Constructive suggestions and criticisms of the material contained in this bulletin will be welcomed.

This bulletin was prepared, under the general direction of Deputy Superintendent L. H. Dennis, by William Penn Loomis, formerly Supervisor of Industrial Education in this Department. The Nanticoke Mining Institute, the Pennsylvania Department of Mines, and the School of Mines of the Pennsylvania State College have also rendered valuable assistance in its preparation.

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Superintendent of Public Instruction

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ORGANIZATION AND COURSE OF STUDY

The Need for Mining Instruction

Pennsylvania has more than 350,000 men employed in and around her coal mines, 160,000 of whom are employed in the Anthracite field. Of this total number, more than 8,000 are officials such as fire bosses, assistant mine foremen, mine foremen and mine inspectors. Mine officials are required by law to pass an examination and obtain certificates of competency in the theory and practice of coal mining. Examinations for officials are conducted and controlled by the State Department of Mines, which Department also controls the issuance of certificates. There are also many practical mining men who are anxious to study under competent mining men those features of mining which have to do with mine gasses, mine ventilation, mining law and other practical mining subjects.

In order to provide men, in and around the anthracite mines of Pennsylvania, with facilities for studying mining subjects, the State Department of Public Instruction, the State Department of Mines and the School of Mines of the Pennsylvania State College, desire to assist groups of persons in the various communities of the coal mining regions in obtaining the kind of instruction they desire. Classes may be promoted by the persons who desire the instruction and organized and conducted under the auspices of the local public school authorities.

Method of Organizing Classes

The following procedure should be used by persons who desire to have classes established for instruction in anthracite mining:

1. When twenty or more men in a mining town wish to form a class for instruction in mining subjects, they should request the school board of the school district in which they reside to conduct an evening class in mining for them. They should also notify the State Department of Public Instruction, Harrisburg, Pa., of their request.
2. If the school board, after due consideration, find that an evening class in mining is desirable for the community, it will open such a class in one of the local schoolhouses or other convenient place. This class will be operated by the school district and no tuition will be charged to residents of the school district.
3. If an evening class in mining is desirable, the school board may receive assistance in organizing such a class from the State Department of Public Instruction. Arrangements

are also possible whereby the school board and the State Department of Public Instruction will jointly bear the expense of the instruction. The State law provides that the State Department of Public Instruction may reimburse the school district to the extent of two-thirds of the salary of a teacher of an approved mining class. It is therefore, important that the administrative official of the school district notify the State Department of Public Instruction, Harrisburg, Pa., whenever a class is organized so that steps may be taken to have the class or classes qualify for state aid.

4. For each class a teacher should be appointed who has had at least six (6) years' experience in the mines. The person selected should have had a good general education, and should have made a study of the technical phases of mining. He should be qualified to hold a position equivalent to that for which the class is preparing. For instance, a class that prepares for a mine foreman's certificate should be taught by a man who holds a mine foreman's certificate.

Before finally appointing a teacher, the administrative officer of the school district should have him apply for a state certificate to teach a class in anthracite mining. Applications for certificates should be addressed to the Teacher Bureau, Department of Public Instruction, Harrisburg, Pa.

5. The Vocational Teacher Training Department of the Pennsylvania State College is prepared to train and to recommend to the State Department of Public Instruction for certification, competent teachers for evening classes in mining subjects. After the teacher has been appointed, he should communicate with the School of Education, Dept. of Industrial Teacher Training, Pennsylvania State College, Pa., and apply for admission to the correspondence course for the training of anthracite mining teachers. This course is designed to help the teacher in the preparation of each lesson given during the year.
6. The teacher training officers connected with the Pennsylvania State College will visit, for the purpose of teacher training, classes which are organized in accordance with the above plan. Officers of the Pennsylvania Department of Public Instruction will inspect and supervise the said classes for the purpose of approval and reimbursement on the part of the State.
7. Lesson material in printed form will be furnished at the cost of printing by the School of Mines of the Pennsylvania

State College. This material has been prepared by the School of Mines in cooperation with the Pennsylvania Department of Mines and the Pennsylvania Department of Public Instruction. Orders for lessons should be addressed to The School of Mines, The Pennsylvania State College, State College, Pa.

8. Classes will usually begin in October or November and continue throughout the winter. They will be held in the evenings, two or three times a week, or at such times as may be locally agreed upon.

State Department of Mines Endorses the Organization of Classes

The Pennsylvania Department of Mines, through the State Secretary of Mines and through its inspectors in the various districts, will encourage and assist employed miners in obtaining technical mining instruction in the public schools.

Department of Public Instruction will Give Further Assistance upon Request

For further information or assistance in organizing or conducting evening mining classes in the public schools of the anthracite region communicate with The Department of Public Instruction, Harrisburg, Pa.

Objectives of the Courses

The following objectives will be maintained for the courses in mining:

1. The major objective is to impart to each man who takes the work a knowledge of mining which will make it possible for him to become an efficient mine foreman or assistant mine foreman.
2. Men who take the course should become familiar with sources of information about their work so that they may continuously improve themselves in their occupation.
3. Men should be prepared to take the state examination for mine foremen and assistant mine foremen.

Entrance Requirements

The following minimum requirements for entrance of persons in the mining course will be followed:

1. At least sixteen years of age.
2. Employed at a mining occupation.
3. Completion of the sixth grade school or its equivalent.
4. Citizens of the United States.

Standards of Operation

The following standards are set for the operation of the course:

1. Completion of the entire course to cover a period of two years.
2. The first year to be presented so that a student may prepare for the position of assistant mine foreman.
3. Classes will be conducted in the evening for sessions of two hours each. Classes to meet not less than twice weekly and not more than three times each week.
4. It is essential that persons completing this course have a knowledge of the fundamentals of arithmetic and the ability to read and write English correctly. It is, however, advisable to give only a minimum amount of formal instruction in these subjects. For this reason none of the units are outlined with the thought of formal instruction in English or arithmetic. The first five units of the course, comprising twenty-six hours of instruction, are intended to give the men an opportunity to strengthen their preparation in the two subjects mentioned. It should be noted, however, that the five units mentioned indicate instruction in English and arithmetic by means of practical applications. All problems and projects whether in English or arithmetic should be very definitely related to the work for which these men are preparing. In addition to this, the instruction should be given very largely by means of practical problems.

All through the course the instructor should take every opportunity to increase the ability of the men to speak and write English correctly. It is also important that, as problems involving mathematical calculations are met in the various parts of the course, the instructor should not only strive to teach the men to work problems but should also endeavor to instill in them an understanding of the various mathematical processes involved. This means that instruction in English and mathematics should continue as incidental objectives throughout both years of the mining course.

5. It will be necessary to train the men in taking examinations. This is especially important for the first year of the course due to the fact that a great many of these men have not taken an examination for a long time. They are practical strangers to the experience of being examined in what they know and can rarely express themselves clearly either

orally or in writing. It should be noted that in the following course outline no time is allotted to tests or examinations. The instructor, however, should give frequent brief written tests to the class. These tests will serve two purposes. First, they will disclose the parts of the instruction which have not gotten across to the men, and second, they will serve as a school for the men in taking examinations. In planning for the examinations mentioned the instructor should give instruction in and stress the following points:

- a. Good form in answering questions.
- b. Good writing and punctuation in examinations.
- c. Correct spelling and neatness.
- d. Clearness and brevity.

6. The instruction in each unit should be classified in the order of mining practice, mathematics and science, mining law, safety, and English wherever possible.
7. The completion of the work of the first year should be followed by an examination and recognized by a proper certificate issued by the school authorities. The completion of work of the second year should be dignified by a school diploma showing the work which has been completed during the entire course.
8. Lesson material should be available for the use of the men. It is necessary that each man have well organized subject matter for study which contains brief but adequate information on the topics which will be studied. Lesson leaflets for the use of the students may be procured at cost from the School of Mines, the Pennsylvania State College, State College, Pa.
9. Each student should also have a copy of the anthracite mining law. Copies may be procured from the State Department of Mines, Harrisburg, Pa.

ANTHRACITE MINING COURSE OUTLINE

First Year

One Hundred Twenty Hours

Unit 1—Mining Law—2 Hours

Topics:

1. Duties of a miner.
2. Duties and qualifications of mine foremen and assistant mine foremen in anthracite mines.
3. Duties and qualifications of fire bosses in anthracite mines.
4. Examining Boards.

Unit 2—Business Letters—2 Hours

Topics:

1. Method of writing business letters.
2. Practice in writing a business letter applied to the man's job.

Unit 3—Mine Arithmetic—6 Hours

Topics:

1. Practical mining problems involving addition, subtraction, multiplication and division and combinations of each.

Unit 4—Mining Terms—2 Hours

Topics:

1. Spelling, pronouncing and definition of words of a general nature used often by mining men.
2. Technical words used in mining.

Unit 5—Mine Arithmetic—14 Hours

Topics:

1. Mining problems involving fundamental operation with common fractions.
2. Mining problems involving reduction of fractions to decimals and fundamental operations with decimals.
3. Mining and wage problems involving percentage.
4. Ratio and proportion.
5. Areas and volumes.

Unit 6—Mine Gases—16 Hours

Topics:

1. Discussion of chemistry and physics as it applies to gases in mines.
2. Chemical elements—hydrogen, carbon, nitrogen, sulphur.
3. Mechanical mixtures—air.
4. Barometers.
5. Chemical compounds—carbon monoxide, carbon dioxide, carburetted hydrogen, hydrogen sulphide.
6. Study of the atmosphere and gases under certain conditions of pressure, temperature and volume.
7. Calculating the weight of a given volume of air at a given temperature and pressure.
8. Explosive mixtures.
9. Calculating cubic feet of flame from exploding gas.
10. Calculating quantity of fresh air necessary to prevent a “cap.”
11. Calculating quantity of fresh air to dilute gas.
12. Calculating time necessary to clear out gas.
13. After damp.
14. Duties of mine foremen or assistant mine foremen in regard to gas accumulations.
15. Procedure in case of dangerous gas accumulation.
16. Reports which are made in connection with examination of mines and abandoned workings which generate gases.
17. Special regulations for gaseous mines.
18. Penalty for neglect of duty by foreman or assistant.

Unit 7—Mine Ventilation—18 Hours

Topics:

1. Objects of mine ventilation.
2. Air currents, pressure and velocity.
3. Measuring instruments—anemometer, water gauge, hydrometer and psychrometer.
4. Calculating volume of air passing through an air-way in cubic feet per minute.
5. Calculating ventilating pressure.
6. Calculating the resistance to the passage of air.
7. Methods of supplying air.
8. Ventilating characteristics of force and exhaust fans.

9. Legal requirements with reference to volume of air passing and direction of flow.
10. Legal requirements in regards to doors.

Unit 8—Mine Explosions and Mine Fires—4 Hours

Topics :

1. Causes and effects of explosions.
2. Methods of preventing explosions.
3. Dangers and precautions to be taken after an explosion.
4. Causes and effects of mine fires.
5. Special dangers in connection with mine fires.
6. Methods of preventing mine fires..
7. Fighting mine fires.

Unit 9—Safety Lamps—8 Hours

Topics :

1. Use of safety lamps in gaseous mines.
2. Principle of the flame lamp and its construction.
3. Early types of lamps.
4. Various types of flame lamps now in use.
5. Method and care in handling safety lamps.
6. U. S. Bureau of Mines requirements for safety lamps.
7. Approved electric lamps for mine use.
8. Legal requirements in regard to use of open lamps, precautions in using safety lamps and lamp stations,

Unit 10—Detection of Fire Damp—2 Hours

Topics :

1. The cap on the flame of a safety lamp and detection of "fire damp."
2. Other fire damp detectors and their use.

Unit 11—Special Legal Provisions in Regard to Safety in Anthracite Mines—8 Hours

Topics :

1. Pillars to be left along adjoining coal properties (Article 3, Section 10).
2. Separate traveling way (Article 4, Section 4),
3. Top of shaft shall be accordingly fenced (Article 4, Section 6).
4. Abandoned slope shall be fenced (Article 4, Section 7).

5. Underground entrances shall be fenced (Article 4, Section 8).
6. Hand rails shall be attached to every cage (Article 4, Section 10).
7. Cages, etc. shall be protected (Article 4, Section 11).
8. Main link, etc. shall be of best quality of iron (Article 4, Section 12).
9. Ropes, etc. shall be examined every day (Article 4, Section 13).
10. Sufficient brake to every drum (Article 4, Section 14).
11. Flanges to prevent rope from slipping off drum (Article 4, Section 15).
12. Substantial structure to sustain pulley (Article 4, Section 16).
13. How truck for landing buckets shall be constructed (Article 4, Section 18).
14. Guides to prevent bucket from swinging (Article 4, Section 20).
15. If strata are not safe shaft shall be cased (Article 4, Section 21).
16. Safety valve for boilers (Article 5, Section 3).
17. All machinery must be protected or covered (Article 5, Section 5).
18. Signal apparatus on breaker (Article 5, Section 7).
19. Extra main door to be provided (Article 10, Section 12).
20. Props and timbers must be furnished workmen (Article 11, Section 1).
21. Safety lamps only to be used in certain mines (Article 12, Rule 9).
22. Signals for ascending and descending (Article 12, Rule 21).
23. Manner of charging coal for blasting (Article 12, Rule 30).
24. Construction of passage way (Article 12, Rule 3).
25. Safety holes at bottom of slopes, etc. (Article 12, Rule 49).
26. Safety blocks (Article 12, Rule 50).
27. Bumpers on mine cars (Article 12, Rule 52).

Unit 12—First Aid—10 Hours

Topics:

1. General directions for first aid man and what he should do.
2. First aid “don’ts.”
3. Electric shock.
4. Resuscitation from asphyxiation by artificial respiration.

5. First aid treatment of hemorrhage and bleeding.
6. Some of the most common dressings for wounds and bleeding.
7. Fractures and broken bones.
8. Sprains, dislocations and burns.
9. Rescue and recovery operations in mines after fires and explosions as stated in handbook published by the Dep't. of Interior, Bureau of Mines, Washington, D. C.

Unit 13—Review—18 Hours

Topics:

1. Review of mine gases.
2. Review of mine ventilation.
3. Review of safety lamps and detection of fire damp.
4. Review of mining law.

Note: In the review the teacher may stress any other topics which in his judgment will best meet the needs of the class.

ANTHRACITE MINING COURSE OUTLINE

Second Year

One Hundred Twenty Hours

Unit 1—Ventilation—30 Hours

Topics:

1. Review of mine gases and general principles of mine ventilation.
2. Review of calculations on volume of air passing, ventilating pressure and resistance to passage of air.
3. Calculations on H. P. of ventilation.
4. Air-ways and how the ventilating current is controlled.
5. Splitting the air current.
6. Practice in conducting air (mine maps may be used in connection with this study).
7. Methods of mine ventilation including natural ventilation and artificial ventilation.
8. Special legal regulations in regard to ventilation.
9. Report of air measurements and number of men employed which is made to mine inspectors.

Unit 2—Coal and Its Origin—4 Hours

Topics:

1. Formation of coal.

2. Classification and characteristics of coal.
3. Location of coal seams.
4. Method of collecting coal samples.
5. Calculating the weight of coal in a given area.

Unit 3—Mine Trigonometry—14 Hours

Topics :

1. Problems involving measurement of angles and the solution of right angle triangles by trigonometry.
2. Problems on grades.
3. Mapping a survey to include an understanding of the scale of a drawing, calculating horizontal and pitch distances, use of protractor, latitude and departure.
4. Surveying, to include an understanding of compass reading, methods of putting up lines and tying a survey.

Unit 4—Methods of Work—6 Hours

Topics :

1. Description of various methods of mining such as “long wall” and “room and pillar” methods.
2. Causes of faults in coal seams and the purpose of rock tunnels.
3. Calculating size of shaft pillars.
4. Calculating size of ordinary pillars.
5. Calculating thickness of barrier pillars.
6. Percentage of coal left in pillars.
7. Method of robbing pillars.
8. Special legal provisions in regard to methods of work.
9. Effect of the subsidence of the overlying strata both inside and on the surface.

Unit 5—Securing Underground Workings—4 Hours

Topics :

1. Methods of securing the shaft, the shaft bottom, roadways and working places.
2. Methods of timbering in case of bad roof, good floor and sides, or in case of bad roof and sides and good floor, or in case of bad roof, sides and floor.
3. Uses of cribs and methods of cribbing.
4. Gunnite method of cementing roof and its advantages.
5. Decay and preservation of timbers.

6. Special legal provisions in regard to props and timbers.
7. Methods of determining safe and unsafe condition of roof.
8. Advantages of systematic timbering in working places.

Unit 6—Drainage and Pumps—6 Hours

Topics:

1. Sources of water in mines.
2. Methods of underground drainage as applies to flat deposits, workings above and below the water level, and inclined coal seams.
3. Mine dams and barrier pillars.
4. Methods of raising water including bucket hoisting, syphons and pumps.
5. Calculating the quantity of water delivered by a syphon.
6. Calculating the capacity of mine pumps.
7. Special legal provisions in regard to drainage.

Unit 7—Explosives—2 Hours

Topics:

1. Requirements of mine explosives.
2. Permissible explosives in mines.
3. Methods of blasting, to include principles of rock blasting.
4. Legal requirements in regard to storage, handling and transportation of explosives.
5. Special safety precautions in regard to thawing dynamite.

Unit 8—Hoisting—8 Hours

Topics:

1. Various methods of hoisting coal.
2. Special mechanical parts of hoisting appliances.
3. Calculations in regard to speed and power ratios on drums, pulleys and gears.
4. Signal apparatus.
5. Special legal requirements in regard to hoisting coal.
6. Safety precautions.

Unit 9—Haulage and Track Work—6 Hours

Topics:

1. Methods of haulage and advantages of each.
2. Types of mine locomotives.

3. Types of mine cars and advantages of each.
4. Types of track work used under various conditions.
5. Calculating quantity of coal hauled using various methods.
6. Calculating the gradient for road-way using mules and inclined plane methods of haulage.
7. Method of finding frictional resistance of mine cars experimentally.
8. Special legal provisions in regard to haulage and haulage roads.

Unit 10—Shaft Sinking and Tunnels—4 Hours

Topics:

1. Types of shafts.
2. Methods of shaft sinking.
3. Types of tunnels.
4. Calculating the quantity of earth and rock excavated together with cost of excavation.
5. Ventilation of shafts during excavation.
6. Law relating to the sinking of shafts.

Unit 11—Electricity in the Mines—20 Hours

Topics:

1. Electrical circuits.
2. Ohms Law.
3. Wiring methods for light and power in mines.
4. Heating effects of electric current.
5. Magnetism and the generation of electricity.
6. Discussion of signal apparatus, electric locomotives and coal cutting machinery.

Unit 12—Safety Standards—4 Hours

Topics:

1. Standards of safety as laid down in the coal mine section, of Pennsylvania Compensation and Inspection Bureau as follows:
 - a. General safety standards
 - b. Surface hazards
 - c. Shaft and slope hazards
 - d. Haulage underground
 - e. Electricity underground
 - f. Height of coal and fall

- g. Explosives
- h. Gas, dust, and fires
- i. Miscellaneous underground hazards

2. Report made to the mine inspector in regard to loss of life.

Unit 13—Review—12 Hours

Topics:

1. Ventilation.
2. Review of mine law.
3. Optional.

Note: The teacher may use any other topics in review that in his judgment will best meet the needs of the class.

REFERENCE BIBLIOGRAPHY FOR ANTHRACITE MINING CLASSES

English

Any standard dictionary may be used.

Anthracite Mining Laws of Pennsylvania, State Dept. of Mines, Harrisburg.

Century Handbook of Writing—Grever & Jones—The Century Company, New York City.

Handbook of Composition—Wooley—D. C. Heath, New York City.

Arithmetic

I. C. S: Mining Textbooks—International Textbook Company Scranton, Pa. (5 booklets)

1. Elements of Arithmetic
2. Fractions
3. Decimals
4. Weights and Measures
5. Ratio and proportion

Practical Mathematics—Palmer—McGraw, Hill Book Co., New York City.

Computation Tables and Formulae—Barker—Ginn & Co., New York City.

Coal Miner's Pocketbook—McGraw.

Constructive Textbook of Practical Mathematics—Vol. 1—Marsh—John Wiley & Sons, New York City.

Coal Miner's Handbook—I. C. S.—International Textbook Company.

NOTE: For the purpose of saving time in making computations it is recommended that the student provide himself with a set of computation tables.

Mine Gases and Explosions

Bulletin No. 39—Coal Mine Gases, by A. C. Callen, Federal Board for Vocational Education, Washington, D. C.

Examination Questions and Answers for Mine Foremen, Assistant Mine Foremen and Fire bosses, Bituminous Region—Pennsylvania Department of Mines, Harrisburg, Pa.

Chemistry and Physics of Mining and Mine Ventilation—J. J. Walsh, D. Van Nostrand Co., New York City.

I. C. S. Mining Textbooks—International Textbook Company, (2 booklets)

1. Properties of Gases.
2. Mine Gases.

Bulletin No. 41—Coal Mine Ventilation, by R. Z. Virgin, Federal Board for Vocational Education, Washington, D. C.

Coal Miner's Pocketbook—Foster—McGraw.

Mine Gases and Ventilation—J. T. Beard—McGraw.

The Investigation of Mine Air—Foster and Holdane.

Examination Questions for Certificates of Competency as Mine Inspector, Mine Foremen, Fire Boss, etc.—International Textbook Company.

Testing with Safety Lamps—Winstanley—Mines and Minerals, Vol. 30, P. 697.

The following publications of the United States Bureau of Mines, can be obtained by addressing the Director, United States Bureau of Mines, Washington, D. C.

Miner's Circular 14. Gases found in Coal Mines.

Miner's Circular 16. Hints on Coal Mine Ventilation.

Miner's Circular 21. What a Miner can do to Prevent Explosion of Gas and Coal Dust.

Bulletin 26. Notes on Explosive Mine Gases and Dusts.

Bulletin 72. Concurrence of Explosive Gases in Coal Mines.

Bulletin 74. Gasoline Mine Locomotives in Relation to Safety and Health.

Bulletin 83. The Humidity of Mine Air.

Bulletin 105. Black Damp in Mines.

Technical Paper 11. The Use of Mice and Birds for detecting Carbon Monoxide.

Technical Paper 13. Gas Analysis as an aid in Fighting Mine Fires.

Technical Paper 39. The Inflammable Gases in Mine Air.

Technical Paper 43. The Effect of Inert Gases on Inflammable Gaseous Mixtures.

Technical Paper 122. Effects of Atmospheres Deficient in Oxygen on small animals and man.

Technical Paper 119. The Limits of Inflammability of Mixtures of Methane and Air.

Technical Paper 134. Explosibility of Gases from Mine Fires.

Technical Paper 150. Limits of Complete Inflammability of Mixtures of Mine Gases and of Industrial Gases with Air.

Technical Paper 190. Methane Accumulations from Interrupted Ventilation.

Safety Lamps

Bulletin No. 42—Safety Lamps, by R. Z. Virgin, Federal Board for Vocational Education, Washington, D. C.

I. C. S. Textbook—Mine Gases (1 pamphlet) International Textbook Company.

Examination Questions for Mine Foremen, Fire boss, etc.,—International Textbook Co.

Publications of the U. S. Bureau of Mines dealing with Safety Lamps:

Bulletin 52. Ignition of mine gases by filament of incandescent electric lamps.

Bulletin 131. Approved electric lamps for miners.

Technical Paper 23. Ignition of mine gas by miniature electric lamps with tungsten filament.

Technical Paper 28. Ignition of mine gas by standard incandescent lamps.

Technical Paper 47. Portable electric mine lamps.

Technical Paper 75. Permissible electric lamps for miners.

Miner's Circular 12. The use and care of miner's safety lamps.

Ventilation

Bulletin No. 41—Coal Mine Ventilation, by R. Z. Virgin—Federal Board for Vocational Education, Washington, D. C.

I. C. S. Mining Textbook—Mine Ventilation (1 Booklet International Textbook Co.

Mine Gases and Ventilation—Beard—McGraw.

Coal Miner's Handbook—I. C. S.—International Textbook Co.

Coal Miner's Pocketbook—Foster—McGraw.

Chemistry and Physics of Mining and Mine Ventilation—J. J. Walsh, Van Nostrand Co.

The following miner's circular may be procured from the Department of Interior, Bureau of Mines, Washington, D. C.

Miner's Circular No. 16—Hints on Coal Mine Ventilation—J. J. Rutledge.

First Aid

Elementary First Aid for the Miner—Lynott and Harrington—Miner's Circular 23, U. S. Department of Interior, Bureau of Mines.

Advanced First Aid for Miners—Handbook, U. S. Department of Interior, Bureau of Mines.

First Aid to the Injured I. C. S. Mining Textbook International Textbook Co.

Resuscitation from Gas Asphyxiation, Drowning and Electric Shock, Department of Interior, Bureau of Mines.

Coal and Its Origin

I. C. S. Mining Textbooks, International Textbook Co., (2 booklets).

1. Geology of coal.

2. Examination of coal properties.

Coal and Coal Mines—Greene—Houghton, Mifflin Co., Boston, Mass.

A Story of a Piece of Coal—Martin—D. Appleton Co., N. Y. City.

Coal and Coal Mining—Smyth—Van Nostrand.

Story of American Coals—Nicolls—J. B. Lippincott Co., Philadelphia.

Coal, Its Origin, Methods of Working—Wilson—Isaac Pitman & Sons, 2-6 W. 45th Street, N. Y. City.

Coal—Moore—Wiley.

Coal Manual—Wadleigh—National Coal Mining News, Cincinnati, O.

Methods of Work

I. C. S. Mining Textbooks—Methods of Working (4 parts, pamphlet form)—International Textbook Co.

Coal Miner's Pocketbook—Foster—McGraw.

Coal Miner's Handbook—I. C. S. International Textbook Co.

Timbering

Coal Mine Timbering, Bulletin No. 40 by R. Z. Virgin—Federal Board for Vocational Education, Washington, D. C.

I. C. S. Mining Textbook—Timbering—International Textbook Co.

Miner's Circular No. 9, Accidents from Falls of Roof and Coal—Department of Interior, Bureau of Mines, Washington, D. C.

Drainage and Pumps

I. C. S. Mining Textbooks—International Textbook Co.

Mine Drainage (1 part)

Mine Pumps (3 parts)

Explosives

I. C. S. Mining Textbooks—Explosives and Blasting—International Textbook Co.

Coal Miner's Pocketbook—Foster—McGraw.

The following publications may be procured from the Department of Interior, Bureau of Mines,

Bulletin 10. The Use of Permissible Explosives.

Bulletin 15. Investigations of Explosives used in Coal Mines.

Bulletin 17. A primer on Explosives for Coal Miners.

Bulletin 66. Tests of Permissible Explosives.

Bulletin 96. The Analysis of Permissible Explosives.

Technical Paper 108. Shot-firing in Coal Mines by Electricity controlled from the outside.

Miner's Circular 7. Use and Misuse of Explosives in Coal Mining.

Blaster's Handbook—E. I. DuPont, DeNemours & Co. Wilmington, Del.

Safety

Anthracite Mining Laws of Pennsylvania, Pennsylvania Department of Mines.

The following Bulletins, etc., may be procured from Department of Interior, Bureau of Mines.

Bulletin 44. First National Mine-Safety Demonstration, Pittsburgh.

Bulletin 69. Coal Mine Accidents in the U. S. and Foreign Countries.

Bulletin 115. Coal Mine Fatalities in the U. S., 1870-1914, etc.

Bulletin 196. Coal Mine Fatalities in the U. S. 1919, etc.

Technical Paper 21. The prevention of mine explosions, etc.

Technical Paper 48. Coal Mine Accidents in the U. S. 1896-1912, etc.

Technical Paper 56. Notes on the prevention of gas and dust explosions in coal mines.

Technical Paper 138. Suggested Safety Rules for Installing and using Electrical Equipment in Bituminous Coal Mines.

Miner's Circular 5. Electrical Accidents in Mines, their causes and prevention.

Miner's Circular 9. Accidents from falls of roof and coal.

Miner's Circular 11. Accidents from Mine Cars and Locomotives.

Miner's Circular 13. Safety in Tunnelling.

Miner's Circular 20. How a miner can avoid some dangerous diseases.

Miner's Circular 21. What a miner can do to prevent explosions of gas and coal dust.

Miner's Circular 22. Dangerous and safe practices in bituminous coal mines.

Hoisting

I. C. S. Mining Textbooks—Hoisting (4 parts)—International Textbook Company.

Coal Miner's Pocketbook—Foster—McGraw.

Haulage

I. C. S. Textbooks—Haulage—Trackwork—International Textbook Company.

Coal Miner's Pocketbook—Foster—McGraw.

Coal Miner's Handbook—International Textbook Co.

Shaft Sinking and Tunnelling

I. C. S. Mining Textbook—Drifts, Slopes and Shafts (1 part)—International Textbook Co.

Electricity

I. C. S. Mining Textbooks. International Textbook Co. Elements of Electricity and Magnetism (1 part), Direct Current

DYNAMOS AND MOTORS (1 part) ALTERNATING CURRENT MACHINERY (1 part) OPERATION OF DYNAMO ELECTRIC MACHINERY (2 parts) TRANSMISSION LIGHTING AND SIGNALLING (1 part).

COAL MINER'S POCKETBOOK—FOSTER—MCGRAW.

ELECTRICITY IN COAL MINING—SHEARER—MCGRAW.

THE FOLLOWING BULLETINS AND CIRCULARS MAY BE PROCURED FROM THE DEPARTMENT OF INTERIOR, BUREAU OF MINES.

BULLETIN 68. ELECTRICAL SWITCHES FOR USE IN GASEOUS MINES.

TECHNICAL PAPER 23. IGNITION OF MINE GAS BY MINIATURE ELECTRIC LAMPS WITH TUNGSTEN FILAMENTS.

TECHNICAL PAPER 28. IGNITION OF MINE GASES BY STANDARD INCANDESCENT LAMPS.

TECHNICAL PAPER 128. SHOT-FIRING IN COAL MINES BY ELECTRICITY CONTROLLED FROM THE OUTSIDE.

TECHNICAL PAPER 138. SUGGESTED SAFETY RULES FOR INSTALLING AND USING ELECTRICAL EQUIPMENT IN BITUMINOUS MINES.

MINER'S CIRCULAR 5. ELECTRICAL ACCIDENTS IN MINES, THEIR CAUSES AND PREVENTION.

**EXTRACTS FROM SCHOOL LAW REFERRING TO
ESTABLISHMENT AND OPERATION OF EVEN-
ING MINING SCHOOLS AND CLASSES
BY PUBLIC SCHOOL BOARDS**

SCHOOL BOARDS ARE AUTHORIZED TO ESTABLISH EVENING MINING SCHOOLS.

PORTION OF SECTION 401 OF SCHOOL CODE:

THE BOARD OF SCHOOL DIRECTORS IN EVERY SCHOOL DISTRICT IN THIS COMMONWEALTH.....may establish, equip, furnish, and maintain the following additional schools or departments for the education and recreation of persons residing in said district, which said additional schools or departments, when established, shall be an integral part of the public school system in such school district, and shall be so administered, namely: HIGH SCHOOLS. MANUAL TRAINING SCHOOLS. VOCATIONAL SCHOOLS. DOMESTIC SCIENCE SCHOOLS. AGRICULTURAL SCHOOLS. EVENING SCHOOLS.

SCHOOL BOARDS OF SECOND AND THIRD CLASS DISTRICTS REQUIRED TO OPERATE EVENING MINING SCHOOLS UNDER CERTAIN CONDITIONS.

SECTION 1901 OF THE SCHOOL CODE:

THE BOARD OF SCHOOL DIRECTORS OF ANY SCHOOL DISTRICT IN THIS COMMONWEALTH, UPON THE WRITTEN APPLICATION OF TWENTY OR MORE PERSONS

above the age of sixteen years, residents of the school district, and not in full-time attendance of any public or private school during the day, shall open a free evening school for their instruction in any course of study taught in the public schools of the district; in English and Citizenship for immigrants and native illiterates; in citizenship for adults; and in such other courses of study as the board may deem advisable. No board of directors shall be required to admit to said evening school any person who is in actual full-time attendance upon any school, either public or private during the day. Provided, that when the average daily attendance for any month, in any course of study falls below ten pupils, the board of school directors may close the class in such course of study, in such evening school for the remainder of the term

State Department of Public Instruction is authorized to reimburse approved evening mining schools under certain conditions.

Section 3406 of the School Code

“Vocational evening class” shall mean a class giving such training as can be taken by persons already employed during the working day and which must in its instruction deal with the subject matter of, and be so carried on as to relate to the day employment.

Section 3413 of the School Code

Vocational industrial.....schools or departments shall, so long as they are approved by the State Council of Education as to organization, control, location, equipment, courses of study, qualifications of teachers, methods of instruction, conditions of admission, employment of pupils, and expenditures of money, constitute approved local or joint vocational schools. School districts maintaining such approved local or joint vocational schools or departments, shall receive reimbursement as hereinafter provided.

Section 3414 of the School Code

The Commonwealth in order to aid in the maintenance of approved local or joint evening vocational industrial.....schools or departments.....shall pay as provided in this act, as amended, annually from the treasury to school districts and unions of school districts maintaining such evening schools or departments in the several classes of districts, an amount equal to two-thirds the sum which was expended for salaries of part-time and evening school teachers and supervisors during the previous school year by such school district or unions of districts for approved instruction in practical and related technical subjects.

Pupils from outside districts may attend evening mining classes and the home district shall pay the tuition.

Portion of Section 3412 of School Code:

Any resident of any school district in Pennsylvania which does not maintain an approved vocational industrial school or department, offering the type of training which he desires, may make application to the school board of any other district for admission to such school or department maintained by said board. In case said board refuses him admission, he may apply to the State Council of Education for admission to such school or department. The State Council of Education—decision of which shall be final—may approve or disapprove such application

IMPORTANT NOTE

School districts which desire to take advantage of the special aid on the salaries of teachers of Evening Mining Classes, should obtain from the State Department of Public Instruction, Harrisburg, Pa., the necessary approval in advance, for the operation of such classes.